

WHAT IS CLAIMED IS:

1. A multi-port fluid coupling for simultaneously connecting a plurality of first fluid lines to corresponding second fluid lines, comprising:

5 a socket member having a tubular socket body defining a cavity therein, the socket body having a forward end and a rear end, the socket member further comprising a plurality of valved, push-to-connect first coupling devices mounted within the cavity and arranged in a non-linear array, each first coupling device having a front end face proximate the forward end of the socket body, the socket body having a substantially
10 cylindrical inner surface;

a plug member having a tubular plug body defining a cavity therein, the plug body having a forward end and a rear end, the plug member further comprising a plurality of valved, push-to-connect second coupling devices mounted within the cavity of the plug body and arranged in a non-linear array matching that of the first coupling devices,
15 each second coupling device having a front end face and being configured to connect with a corresponding one of the first coupling devices when said coupling devices are axially pushed together such that valves of the coupling devices are opened to establish a flow path therebetween, the plug body having a substantially cylindrical outer surface of smaller diameter than the inner surface of the socket body such that the forward end of
20 the plug body is axially receivable into the forward end of the socket body to cause the front end faces of the second coupling devices to abut the front end faces of the first coupling devices, further axial movement of the plug body into the socket body causing the first and second coupling devices to be connected; and

cooperative first and second cam members respectively mounted on the socket
25 member and plug member and engageable with each other upon initial engagement of the plug member with the socket member, one of the first and second cam members being rotatable relative to the other about an axis of the multi-port fluid coupling so as to axially advance the plug body into the socket body to connect the first and second coupling devices.

30 2. The multi-port fluid coupling of claim 1, wherein the cam members comprise cam surfaces defined on one of the socket and plug members and cam followers mounted

on the other of the socket and plug members for contacting and riding along the cam surfaces, the cam surfaces each having a first portion that extends generally helically along said one of the socket and plug members such that rotation of the cam surfaces about the axis relative to the cam followers causes the cam followers to ride along the first portions of the cam surfaces thereby axially advancing the plug body into the socket body.

3. The multi-port fluid coupling of claim 2, wherein the plug member includes an actuator rotatably mounted coaxially about the plug body, the cam surfaces being defined by slots formed in the actuator, and wherein the cam followers are mounted on the socket body for engagement in the slots in the actuator.

4. The multi-port fluid coupling of claim 3, wherein the cam followers comprise rollers mounted on the plug body with rotational axes of the rollers oriented radially relative to the plug body.

5. The multi-port fluid coupling of claim 3, wherein the cam surfaces each comprises a second portion at a terminal end of the slot, the second portions of the cam surfaces being configured to cause no further axial advancement of the plug body into the socket body as the cam followers ride along the second portions, the second portions thus serving to lock the socket and plug members together.

6. The multi-port fluid coupling of claim 5, wherein the second portions of the cam surfaces extend circumferentially along the actuator.

7. The multi-port fluid coupling of claim 3, further comprising at least one handle mounted on the actuator for grasping to aid in rotating the actuator.

8. The multi-port fluid coupling of claim 1, further comprising:
male alignment members mounted on one of the socket and plug bodies and female alignment members defined in the other of the socket and plug bodies, the female alignment members being aligned with the male alignment members in only one rotational orientation of the plug body relative to the socket body in which orientation the first and second coupling devices are properly aligned, and wherein the male alignment

members are arranged to contact said other of the socket and plug bodies to prevent the front end faces of the first and second coupling device from coming into contact until the male alignment members are engaged in the female alignment members.

5 9. The multi-port fluid coupling of claim 8, wherein the male alignment members are mounted on the plug member and the female alignment members are defined in the socket body.

10 10. The multi-port fluid coupling of claim 9, wherein the male alignment members comprise pins located radially outwardly of the plug body and spaced apart circumferentially, and the female alignment members comprise holes defined in the socket body for receiving the pins.

11. The multi-port fluid coupling of claim 10, wherein the pins and the holes are circumferentially spaced non-uniformly such that all of the pins align with corresponding holes in only one rotational orientation of the plug body relative to the socket body.

15 12. The multi-port fluid coupling of claim 11, wherein the pins are arranged in a plurality of pairs, the pins of each pair being circumferentially spaced by a distance that is less than a spacing distance between adjacent pairs, the pairs being circumferentially spaced non-uniformly.

13. The multi-port fluid coupling of claim 12, wherein the distance between the pins of each pair is different from the distance between the pins of the other pairs.

20 14. A multi-port fluid coupling for simultaneously connecting a plurality of first fluid lines to corresponding second fluid lines, comprising:

25 a socket member having a tubular socket body defining a cavity therein, the socket body having a forward end and a rear end, the socket member further comprising a plurality of valved, push-to-connect first coupling devices mounted within the cavity and arranged in a non-linear array, each first coupling device having a front end face proximate the forward end of the socket body, the socket body having a substantially cylindrical inner surface;

a plug member having a tubular plug body defining a cavity therein, the plug body having a forward end and a rear end, the plug member further comprising a plurality of valved, push-to-connect second coupling devices mounted within the cavity of the plug body and arranged in a non-linear array matching that of the first coupling devices, each second coupling device having a front end face and being configured to connect with a corresponding one of the first coupling devices when said coupling devices are axially pushed together such that valves of the coupling devices are opened to establish a flow path therebetween, the plug body having a substantially cylindrical outer surface of smaller diameter than the inner surface of the socket body such that the forward end of the plug body is axially receivable into the forward end of the socket body to cause the front end faces of the second coupling devices to abut the front end faces of the first coupling devices, further axial movement of the plug body into the socket body causing the first and second coupling devices to be connected; and

male alignment members mounted on one of the socket and plug bodies and female alignment members defined in the other of the socket and plug bodies, the female alignment members being aligned with the male alignment members in only one rotational orientation of the plug body relative to the socket body in which orientation the first and second coupling devices are properly aligned, and wherein the male alignment members are arranged to contact said other of the socket and plug bodies to prevent the front end faces of the first and second coupling device from coming into contact until the male alignment members are engaged in the female alignment members.

15. The multi-port fluid coupling of claim 14, wherein the male alignment members are mounted on the plug member and the female alignment members are defined in the socket body.

16. The multi-port fluid coupling of claim 15, wherein the male alignment members comprise pins located radially outwardly of the plug body and spaced apart circumferentially, and the female alignment members comprise holes defined in the socket body for receiving the pins.

17. The multi-port fluid coupling of claim 16, wherein the pins and the holes are circumferentially spaced non-uniformly such that all of the pins align with corresponding holes in only one rotational orientation of the plug body relative to the socket body.

18. The multi-port fluid coupling of claim 17, wherein the pins are arranged in a plurality of pairs, the pins of each pair being circumferentially spaced by a distance that is less than a spacing distance between adjacent pairs, the pairs being circumferentially spaced non-uniformly.

19. A socket member for a multi-port fluid coupling that simultaneously connects a plurality of first fluid lines to corresponding second fluid lines, comprising:

10 a tubular socket body defining a cavity therein, the socket body having a forward end and a rear end, and a plurality of valved, push-to-connect coupling devices mounted within the cavity and arranged in a non-linear array, each coupling device having a front end face proximate the forward end of the socket body, the socket body having a substantially cylindrical inner surface; and

15 a plurality of circumferentially spaced cam members mounted on the socket body for engaging cam members on a cooperative plug member of the multi-port fluid coupling.

20. The socket member of claim 19, wherein the cam members comprise cam followers mounted on the socket body projecting radially outward therefrom.

20 21. The socket member of claim 20, wherein the cam followers comprise rollers.

22. A plug member for a multi-port fluid coupling that simultaneously connects a plurality of first fluid lines to corresponding second fluid lines, comprising:

25 a tubular plug body defining a cavity therein, the plug body having a forward end and a rear end, and a plurality of valved, push-to-connect coupling devices mounted in a non-linear array within the cavity of the plug body, the plug body having a substantially cylindrical outer surface;

an actuator rotatably mounted about the plug body; and

a plurality of circumferentially spaced cam members defined in the actuator for engaging cam members on a corresponding socket member of the multi-port fluid coupling.

23. The plug member of claim 22, wherein the cam members comprise cam
5 surfaces each including a first portion that extends helically along the actuator with a rearward axial component toward a rear end of the actuator.

24. The plug member of claim 23, wherein the cam surfaces are defined by slots in the actuator.

25. The plug member of claim 23, wherein the cam surfaces each includes a
10 second portion that extends with no rearward axial component.